Comment on Laudan

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> *"Lenity of Juries and frequency of Pardons are in the main a much greater Cruelty to a populous State or Kingdom, than the use of Racks and the most exquisite Torments."*
> – Bernard Mandeville[1]

I. INTRODUCTION

Larry Laudan has made a bold proposal for improving the criminal justice system. He considers the costs and benefits of a lower standard of proof for "serial felons." These persons have a greater chance to commit serious crimes in the future, and should, therefore, be given less opportunity to do so. The standard of proof for serial felons should not be the current lenient standard of "beyond a reasonable doubt," but the more severe standard of "clear and convincing evidence." Lenity of juries, Laudan finds, is in the main a great cruelty to the people.

Laudan's logic is a straightforward implication of his decision-theoretic framework. The standard of proof should emerge from a calculation of costs and benefits in just the way John Kaplan described in his influential 1968 paper, *Decision Theory and the Fact-Finding Process*.[2] The jury should

[1] 1 BERNARD MANDEVILLE, THE FABLE OF THE BEES: OR, PRIVATE VICES, PUBLIC BENEFITS 145 (1795).

[2] John Kaplan, *Decision Theory and the Factfinding Process*, 20 STAN. L. REV. 1065

convict if and only if the expected costs of acquittal exceed the expected benefits. The cost of acquittal is the probability of guilt, P_g, times the "disutility of acquitting a guilty man." The benefit of acquittal is one minus the probability of guilt $(1 - P_g)$ times the disutility of "convicting an innocent man." This principle yields an inequality in which the threshold probability of guilt—the standard of proof—depends on the *ratio* of the disutility of acquitting a guilty person to the disutility of convicting an innocent person. The higher this ratio, the lower the optimal standard of proof. (Following Laudan's good example I ignore as irrelevant to the current discussion the otherwise important refinements found in Tribe's subsequent contribution.[3]) The likely costs of letting a serial offender off are greater than the likely costs of letting a first offender off, and so, the standard of proof should be lower for the serial felon.

Laudan's logic may seem to be a kind of scientific inevitability. Laudan's subtitle calls for "empiricizing" the rules of criminal law. Empirical evidence subject to rational analysis yields a standard of proof that varies optimally with costs and benefits. Who would argue with science, logic, and empirical evidence? Laudan's scientific analysis of costs and benefits seems well-crafted to make any self-respecting economist happy. I am an economist. And yet I am not happy.

A. *The Rate of False Convictions*

Laudan estimates the rate of false conviction at about 3% for violent felonies.[4] As far as I can tell, he relies on two studies, that of Risinger[5] and that of Gross et al.[6] I think we may have reason to fear that his 3% value is too low. Risinger clearly establishes his rate as a "minimum factual rate," and that only for a rather narrow class of cases. Risinger does not think the true rate in his class of cases likely exceeds 5%, but the calculated rate is a minimum and not an estimate of the true value in any class of cases. Similarly, Gross et al. provide a highly conservative estimate that explicitly excludes several known cases of "mass exoneration." Thus, both Risinger's

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(1968).

    [3] Laurence H. Tribe, *Trial by Mathematics: Precision and Ritual in the Legal Process*, 84 HARV. L. REV. 1329 (1971).

    [4] Paul Cassell has pointed out to me that Laudan's 3% figure does not enter his calculation of costs and benefits from alternative standards of proof. But his calculation of differential harm from acquitting serial offenders depends on the assumption that they probably did the crimes they were convicted of. It depends, therefore, on the assumption of a relatively low rate of false convictions, such as 3%.

    [5] D. Michael Risinger, *Innocents Convicted: An Empirical Justified Factual Wrongful Conviction Rate,* 97 J. CRIM. L. & CRIMINOLOGY 761 (2007).

    [6] Samuel R. Gross, Kristen Jacoby, Daniel J. Matheson, Nicholas Montgomery & Sujata Patil, *Exonerations in the United States, 1989 through 2003*, 95 J. CRIM. L. & CRIMINOLOGY 523, 523–60 (2005).

estimate and that of Gross et al. are biased downward.

Laudan neglects the jury study of McCabe and Purves, which yields a minimum possible error rate of 12.5%.[7] McCabe and Purves created shadow juries to hear criminal cases in three British courts. The shadow juries heard the same evidence as the real juries and deliberated independently. Shadow juries were present in 30 cases. In one of the cases, the real jury was hung. Five of the shadow juries were hung, but the researchers took the majority vote if at least 8 of the 12 shadow jurors agreed, leaving only one hung shadow jury. Thus, two cases were eliminated from the study. In 7 of the remaining 28 cases, the shadow jury and the real jury reached different verdicts. Thus, the average overall error rate of the two types of juries in this study cannot have been less than one in eight, or 12.5%.[8] This figure is an average overall error rate for the study and not a rate of false convictions. It could be that in all seven cases the defendant was in fact guilty, so that none of the mistaken verdicts represent the potential for false conviction. Of course, the opposite possibility seems no less possible. And, finally, the juries may have been wrong in some or, theoretically, all cases in which they agreed. Thus, the 12.5% rate is the minimum logically possible error rate in the study. The McCabe and Purves study suggests to me that Laudan's 3% estimate is too conservative.

B. *Bayesian Rational Juries*

Laudan proposes that, when the defendant is a "serial felon" judges should instruct juries to find the defendant guilty if the evidence against them is "clear and convincing." Otherwise, judges in criminal cases should instruct juries to convict only if the evidence given in court establishes guilt "beyond a reasonable doubt." Jurors will know, then, whether the defendant is a "serial felon" and incorporate that information into their calculations. In some cases, the defendant's history will be information the jury would not otherwise have had. In other cases, it is information the jury would otherwise have had.[9]

Let us separate the criminal record of the defendant or suspect from all the other evidence that fact finders will consider in Laudan's analysis. Let us imagine that information on the person's record comes in before the rest

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[7]   SARAH MCCABE & ROBERT PURVES, THE SHADOW JURY AT WORK 18, 19 (1974). This paragraph is mostly lifted from Roger Koppl & Meghan Sacks, *The Criminal Justice System Creates Incentives for False Convictions*, 32 CRIM. JUST. ETHICS 126 (2013).

[8]   *See* McCabe and Purves, *supra* note 7. The two juries disagreed on one in four cases. In each such case, one jury was right and the other wrong, making the average error rate at least half of one in four, i.e., one in eight. *Id.*

[9]   There are many exceptions in American criminal law to the common-law default rule that the defendant's criminal record be excluded from trial. *See*, *e.g.*, James B. Jacobs, *Admissibility of the Defendant's Criminal Records at Trial*, 4 BEIJING L. REV. 120–27 (2013).

of the evidence and consider how Bayesian-rational fact finders would update their "prior," which is determined by that record. Kaplan correctly infers from the mathematics of Bayesian updating that "the order in which evidence comes in will not affect our rational decisionmaker."[10] Thus, we are imagining the suspect's record to come in first only for our convenience. Let the inelegant label "main evidence" identify all the evidence available to the jury *besides* whether the defendant is a serial felon.[11]

Let δ be the jury's "prior" probability of the suspect being guilty, based on the information whether the defendant is or is not a "serial felon." Then $(1 - \delta)$ is the "prior" probability of innocence.

Let r be a continuous variable corresponding to the strength of the main evidence against the defendant. For guilty defendants, the probability density function is $f_g(r)$; for innocent suspects, it is $f_n(r)$. It is tempting to say that $f_g(r)$ is the conditional probability of r given the defendant's guilt and $f_n(r)$ is the conditional probability of r under the hypothesis of the defendant's innocence. But because we are assuming that r is a continuous variable, these interpretations would not be strictly correct. The proof given in the appendix shows, however, that this mathematical nicety does not affect my argument. We can plug these probability density function realizations into Bayes formula as if they were indeed conditional probabilities. Given a test result r, the jury must update its belief about the likelihood of guilt. The updated probability will be:

$$\Pr(guilty \mid r) = \frac{\delta f_g(r)}{\delta f_g(r) + (1-\delta)f_n(r)} \qquad (1)$$

Laudan's proposal may now be interpreted as a twofold requirement. First, juries should be told whether the defendant is a serial felon even in those cases in which this information would have been excluded from the trial. This is true because revealing the standard of proof will necessarily reveal whether the defendant is a serial felon. Second, for serial felons, the standard of proof, which is the left-hand side of equation (1), should correspond to "clear and convincing evidence." Laudan says that standard of proof is "more or less in the 70% range." But with this proposal, jurors would be asked to convict serial felons on main evidence that might be weak or, in some cases, *exculpatory*. From equation (1) we can easily compute,

$$f_g/f_n$$

[10]   Kaplan, *supra* note 2, at 1085.

[11]   The mathematical part of my argument borrows (even in some of its exact wording) from Glen Whitman, & Roger Koppl, *Rational Bias in Forensic Science*, 9 LAW, PROBABILITY AND RISK 69 (2010). That work, in turn, builds on Hal R. Arkes & Barbara A. Mellers. *Do Juries Meet Our Expectation?*,26 LAW AND HUM. BEHAV. 625 (2002).

for given values of delta and standard of proof, the threshold value of
above which the jury should convict. The table shows how this threshold
value varies with δ when the standard of proof is "clear and convincing
evidence" and when it is "beyond a reasonable doubt."

δ	Threshold value of f_g/f_n when standard of proof is "clear and convincing evidence"	Threshold value of f_g/f_n when standard of proof is "beyond a reasonable doubt"
0	infinite	infinite
0.1	21	81
0.2	9.33	36
0.3	5.44	21
0.4	3.5	13.5
0.5	2.33	9
0.6	1.56	6
0.7	1.00	3.86
0.8	0.58	2.25
0.9	0.26	1.00
1	0	0

When the standard of proof is "clear and convincing evidence," the threshold shifts from inculpatory to exculpatory when delta rises above 0.7. Thus, a moderately high "prior" belief in the defendant's guilt is sufficient to induce the jury to convict when the main evidence presented in court is more exculpatory than incriminating! Perhaps that is a result Laudan is happy with. I confess that I am not happy with such a result. If the standard of proof is 0.9, that threshold is not crossed until the prior belief in the defendant's guilt exceeds 0.9.

Laudan does not address the issue whether changing the standard of proof will change who is arrested and put through either trial or the plea bargaining process. But if it becomes easier to convict serial felons, the authorities will have a stronger incentive to find past felons to blame for unsolved crimes. This change in behavior would seem to increase the risk of false convictions. As the New York Police Department's Schoolcraft scandal illustrates, we must assume that police officers and prosecutors will respond to incentives, just as all other humans generally do.[12] Who gets swept into the net of justice should be endogenous to our model, not exogenous. I note elsewhere, "In the theory of experts, as in all of social science, *all* agents must be modeled if we are to minimize the risk of proposing policies that would require some actors to behave in ways that are inconsistent with their incentives or beyond human capabilities."[13] In this case, it would be inconsistent with their incentives if police were to ignore ease of conviction or otherwise clearing the case when deciding whom to arrest.

I think Laudan underestimates the rate of false conviction in the United States today. And his proposal for a lower standard of proof would seem to sometimes encourage juries to return a guilty verdict when the "main evidence" in more exculpatory than inculpatory. I am, therefore, unhappy with his proposal notwithstanding its foundations in a scientific analysis of costs and benefits, which I, as an economist, can appreciate. In the United States today, Lenity of Juries is in the main a much lesser Cruelty to a populous State or Kingdom than Larry Laudan would have us believe.

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[12]   *See* Koppl & Sacks, *supra* note 7.
[13]   KOPPL, ROGER, EXPERT FAILURE 80 (Cambridge University Press 2018).

APPENDIX: PROOF OF UPDATED PROBABILITY OF GUILT

To find the probability of guilt given a specific test result $\hat{r}$, we need to update the prior probability of guilt (a discrete distribution) on the basis of a continuous variable. The object is to prove that:

$$\Pr(guilty \mid \hat{r}) = \frac{\delta f_g(\hat{r})}{\delta f_g(\hat{r}) + (1-\delta) f_n(\hat{r})}$$

Whitman and I strongly suspected that someone had already proven this result or one very close to it. But since we did not find such a proof, we devised a proof of our own, which, however, did not make it into the published version. I reproduce it here verbatim.

Suppose $r \in [\hat{r} - \varepsilon, \hat{r} + \varepsilon]$. Applying Bayes' Rule, the conditional probability of guilt is given by:

$$\Pr(guilty \mid \hat{r} - \varepsilon \le r \le \hat{r} + \varepsilon) = \frac{\delta \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r}) dr}{\delta \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r}) dr + (1-\delta) \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_n(\hat{r}) dr}$$

Take the limit of both sides of our conditional probability:

$$\lim_{\varepsilon \to 0} \Pr(guilty \mid \hat{r} - \varepsilon \le r \le \hat{r} + \varepsilon) = \lim_{\varepsilon \to 0} \frac{\delta \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r}) dr}{\delta \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r}) dr + (1-\delta) \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_n(\hat{r}) dr}$$

Apply L'Hôpital's Rule to find:

$$\lim_{\varepsilon \to 0} \Pr(guilty \mid \hat{r} - \varepsilon \le r \le \hat{r} + \varepsilon) = \lim_{\varepsilon \to 0} \frac{\frac{\partial}{\partial \varepsilon} \left[\delta \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r}) dr \right]}{\frac{\partial}{\partial \varepsilon} \left[\delta \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r}) dr + (1-\delta) \int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_n(\hat{r}) dr \right]}$$

We will now need the following Lemma:

> **Lemma**. Consider only the integral in the numerator of the above equation:

$$\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = \int_{\hat{r}-\varepsilon}^{\hat{r}} f_g(\hat{r})dr + \int_{r}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = -\int_{\hat{r}}^{\hat{r}-\varepsilon} f_g(\hat{r})dr + \int_{\hat{r}}^{\hat{r}+\varepsilon} f_g(\hat{r})dr$$

> Apply the Fundamental Theorem of Calculus and the Chain Rule to show that:

$$\frac{\partial}{\partial \varepsilon}\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = f_g(\hat{r}-\varepsilon) + f_g(\hat{r}+\varepsilon)$$

> (The proof of the lemma is expanded below.) Similarly:

$$\frac{\partial}{\partial \varepsilon}\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_n(\hat{r})dr = f_n(\hat{r}-\varepsilon) + f_n(\hat{r}+\varepsilon)$$

Substitute in the results of the lemma to find:

$$\lim_{\varepsilon\to 0}\Pr(guilty\,|\,\hat{r}-\varepsilon \le r \le \hat{r}+\varepsilon) =$$

$$\lim_{\varepsilon\to 0}\frac{\delta\big(f_g(\hat{r}-\varepsilon)+f_g(\hat{r}+\varepsilon)\big)}{\delta\big(f_g(\hat{r}-\varepsilon)+f_g(\hat{r}+\varepsilon)\big)+(1-\delta)\big(f_n(\hat{r}-\varepsilon)+f_n(\hat{r}+\varepsilon)\big)}$$

$$\lim_{\varepsilon\to 0}\Pr(guilty\,|\,\hat{r}-\varepsilon \le r \le \hat{r}+\varepsilon) = \frac{2\delta f_g(\hat{r})}{2\delta f_g(\hat{r})+2(1-\delta)f_n(\hat{r})}$$

And thus:

$$\Pr(guilty\,|\,\hat{r}) = \frac{\delta f_g(\hat{r})}{\delta f_g(\hat{r})+(1-\delta)f_n(\hat{r})}\,,\ \text{QED.}$$

Further details on the Lemma. Before taking derivatives, we had:

$$\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = -\int_{\hat{r}}^{\hat{r}-\varepsilon} f_g(\hat{r})dr + \int_{\hat{r}}^{\hat{r}+\varepsilon} f_g(\hat{r})dr$$

Let $y = \hat{r} - \varepsilon$ and $z = \hat{r} + \varepsilon$. Then we have:

$$\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = -\int_{\hat{r}}^{y} f_g(\hat{r})dr + \int_{\hat{r}}^{z} f_g(\hat{r})dr$$

Apply the Chain Rule to each term on the right to get:

$$\frac{\partial}{\partial \varepsilon}\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = -\frac{\partial}{\partial y}\left[\int_{\hat{r}}^{y} f_g(\hat{r})dr\right]\frac{\partial y}{\partial \varepsilon} + \frac{\partial}{\partial z}\left[\int_{\hat{r}}^{z} f_g(\hat{r})dr\right]\frac{\partial z}{\partial \varepsilon}$$

Apply the Fundamental Theorem of Calculus to each term on the right to get:

$$\frac{\partial}{\partial \varepsilon}\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = -f_g(y)\frac{\partial y}{\partial \varepsilon} + f_g(z)\frac{\partial z}{\partial \varepsilon}$$

Substitute in $y = \hat{r} - \varepsilon$ and $z = \hat{r} + \varepsilon$, along with their derivatives with respect to ε, to get:

$$\frac{\partial}{\partial \varepsilon}\int_{\hat{r}-\varepsilon}^{\hat{r}+\varepsilon} f_g(\hat{r})dr = f_g(\hat{r} - \varepsilon) + f_g(\hat{r} + \varepsilon)$$

which is the lemma's conclusion.